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CANADA
and the
REVOLUTION IN MILITARY AFFAIRS

by

DR. ELINOR C. SLOAN

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DIRECTORATE OF STRATEGIC ANALYSIS

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Dr. Elinor C. Sloan

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ABSTRACT

This paper discusses Canada and the Revolution in Military Affairs. It looks at the extent to which the concept is reflected in current Canadian defence policy, examines measures Canada is taking in the key technological and doctrinal/organisational areas of the RMA, and outlines some important contextual factors Canada may want to bear in mind as it continues to develop its approach to the RMA. The paper concludes that while the large, mass army of the Industrial era was not a feasible option for Canada, the smaller, more technologically capable force of the Information Age is well within its reach.

RÉSUMÉ

Ce document porte sur le Canada et la Révolution dans les affaires militaires (RAM). Il examine dans quelle mesure ce concept se reflète dans la politique de défense du Canada, il se penche sur les mesures adoptées par le Canada dans les principaux secteurs technologiques et doctrinaux/organisationnels de la RAM, et il décrit quelques facteurs contextuels importants dont le Canada devrait peut-être tenir compte dans son approche à l'égard de la RAM. La conclusion du document est la suivante : le Canada n'aurait pas pu se doter d'une armée gigantesque du type de celles qui ont dominé l'ère industrielle, mais il est très capable de se doter d'une armée digne de l'ère de l'information, c'est-à-dire plus petite et davantage axée sur la technologie.

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INTRODUCTION

1. La révolution dans les affaires militaires (RAM) est l'un des plus importants phénomènes qui influeront sur la politique du Canada en matière de sécurité et de défense au cours des 20 prochaines années. L'expression désigne un changement profond dans la nature de la guerre; changement que provoqueront les progrès de la technologie militaire qui, conjugués aux transformations dramatiques de la doctrine et des concepts organisationnels militaires, modifient fondamentalement le caractère et la conduite des opérations des forces armées.

2. Les principaux changements technologiques, doctrinaux et organisationnels allant de pair avec la RAM comprennent les éléments suivants, sans toutefois s'y limiter :

Technologie

- Procéder à des frappes dites «chirurgicales» axées sur le lancement de munitions guidées de précision.
- Parvenir à une « prise de conscience poussée de l'espace de bataille », grâce à des moyens perfectionnés de collecte de renseignements, de surveillance et de reconnaissance, y compris des aéronefs de surveillance, des véhicules aériens télépilotés et des satellites.
- Disposer de capacités de pointe aux chapitres du commandement, du contrôle, des communications, des ordinateurs et du traitement des renseignements.

Doctrine

- Des opérations caractérisées par une collaboration toujours plus grande entre les marines, les armées de terre et les forces aériennes (et, dans certains cas, l'infanterie de marine)–une action interarmées–et par la formation de coalitions entre les forces armées de différents pays

–opérations combinées–ce qui rendra l'interopérabilité entre les armes et les armées particulièrement importante.

- Des forces terrestres capables de plus de rapidité, de mobilité et de souplesse qui, bien que de taille réduite, demeureront très meurtrières.
- À long terme, l'abandon des aéronefs pilotés au profit des engins télépilotés, surtout pour la reconnaissance mais aussi, de plus en plus, pour le combat.
- Un changement de cap : de la guerre en mer, on passera à des forces navales qui projetteront leur puissance depuis la mer vers la terre dans le contexte des guerres de littoral.

Organisation

- Des unités plus petites et plus faciles à combiner et à adapter à des missions bien précises, en raison de leur caractère modulaire.
- Un processus décisionnel plus décentralisé, du fait qu'aux échelons inférieurs, les forces seront plus conscientes de la conjoncture et davantage en mesure de contrôler l'espace de bataille que ce n'était le cas auparavant.
- Les pays concernés par la RAM des forces professionnelles et un personnel militaire plus instruit.

ÉNONCÉS DE POLITIQUE ET VISION DES CHOSES

3. Le ministère de la Défense nationale (MDN) et les Forces canadiennes (FC) sont au courant depuis plusieurs années des progrès technologiques formidables qui sont en train de « révolutionner » l'art de la guerre, mais il y a relativement peu de temps qu'ils s'intéressent de près à la RAM, *dans son ensemble*, et à ses conséquences pour le Canada. C'est en partie à la suite des travaux sur cette question effectués par la Direction de l'analyse stratégique, en 1997 et 1998, que le Comité de gestion de la Défense a demandé au Ministère, en mai 1998, de définir une perspective canadienne sur la RAM. Le MDN a donné suite à cette directive en organisant deux conférences de haut niveau. Le symposium ayant pour thème *La défense du Canada au-delà de 2010* (novembre et décembre 1998) portait sur l'incidence de la RAM sur diverses

activités des FC et du Ministère, tandis qu'en avril 2020, la conférence intitulée *Creating the Canadian Forces of 2020* (Bâtir les Forces canadiennes de 2020) mettait l'accent sur l'élaboration et la mise à l'essai des concepts et sur l'intégration de la modélisation et de la simulation à toutes les activités du MDN et des FC.

4. À partir de 1997, des documents-cadres définissant la vision des diverses armes du Canada ont commencé à faire allusion à la RAM. Ainsi, l'étude intitulée *Changement de cap : une stratégie navale pour le Canada* (avril 1997) examinait de nombreux éléments technologiques de la RAM et certaines de ses conséquences doctrinales et organisationnelles, tout comme le faisait d'ailleurs le document *L'Armée de terre du Canada* (avril 1998). Mis à part les travaux exécutés par les armes individuelles, plusieurs documents stratégiques plus récents d'envergure pan-ministérielle parlent des technologies et des concepts afférents à la RAM : mentionnons *Façonner l'avenir de la défense canadienne : une stratégie pour l'an 2020* (juin 1999) et *Guide de planification de la Défense 2000* (août 1999).

MESURES CONCRÈTES ADOPTÉES FACE À LA RAM

5. Les Forces canadiennes ont déjà pris certaines mesures limitées pour se doter des technologies de pointe associées à la RAM. Le MDN est en train d'acheter son premier système spécialisé de communications par satellite militaire, la Force aérienne a équipé ses *CF-18* des dispositifs nécessaires pour exécuter des frappes de précision, la Force terrestre est en voie de « numériser » le champ de bataille, et la Marine a modernisé les systèmes de communications par satellite à bord des destroyers de la classe *Iroquois*. Au chapitre des technologies que suppose la RAM, les Forces canadiennes accusent des lacunes marquées sur divers plans : les systèmes de précision guidés par satellite; les systèmes d'information sur l'espace de bataille tels que les véhicules aériens télépilotés opérationnels et stratégiques; les missiles d'attaque mer-sol pour la projection de la puissance navale contre des objectifs à terre. Au cours des opérations militaires internationales, le Canada, comme bon nombre de ses alliés, dépend presque entièrement des États-Unis à ce dernier égard.

6. En outre, le Canada a commencé à prendre des mesures qui concordent avec les tendances de la RAM en matière de doctrine et d'organisation. Afin de donner plus d'ampleur à leur dimension « interarmées », les FC ont fait fusionner la 1re Division du Canada, à Kingston, et le quartier général de la Force interarmées pour créer ainsi le quartier général interarmées du Canada; il s'agit d'une organisation de commandement et de contrôle déployable, capable d'assurer le commandement et le soutien logistique à la force nationale, au niveau opérationnel de la guerre. Les FC mettent aussi l'accent sur l'action interarmées grâce à des manoeuvres telles que l'Exercice maritime opérationnel d'entraînement coordonné (MARCOT), qui fait intervenir des éléments des trois armes du Canada. L'armée de terre s'affaire par ailleurs à transformer la Force terrestre canadienne en une armée de demain : ce sera une force expéditionnaire optimisée munie d'armes de précision, d'unités modulaires et de matériel plus léger et plus mobile. À cette fin, l'Armée de terre est en train de rationaliser sa flotte de véhicules blindés de combat en favorisant les véhicules sur roues plutôt que les véhicules chenillés.

7. En outre, en janvier 2000, le Ministre a annoncé l'intention des FC de mettre sur pied une force de frappe prête au combat et capable de réagir rapidement aux crises éclatant dans le monde, dans le cadre des missions organisées par l'OTAN ou l'ONU. Le transport stratégique sera déterminant dans ce contexte; or, c'est un domaine où les ressources des FC sont limitées. Les avions *Hercules* et *Polaris* sont souvent utilisés jusqu'à l'excès, et les FC n'ont aucun navire spécialisé de transport maritime. Le MDN a entrepris des études afin de cerner les besoins à venir des FC en matière de transport stratégique. Un des éléments de la solution éventuelle sera sans doute une capacité de soutien logistique à la mer et de transport maritime (ALSC), qui permettrait à la fois de réapprovisionner la flotte en mer et d'assurer le transport stratégique des unités terrestres et, dans le théâtre des opérations, un soutien à des forces interarmées déployées à terre.

8. Le Canada n'a rien fait de concret sur un troisième plan de la doctrine de la RAM, soit celui des véhicules aériens télépilotés utilisés pour le combat. Cela n'est pas surprenant, vu que le *Livre blanc sur la défense* de 1994 précisait bien que le Canada ne chercherait pas à se doter d'une gamme complète de moyens militaires. Jusqu'ici, l'accent a été mis sur la modernisation de ses avions de chasse (pilotés) *CF-18* et sur l'acquisition éventuelle de nouveaux avions de ce

genre, tels que l'avion de combat interarmées, construit aux États-Unis. Enfin, la Force maritime du Canada a commencé à changer de cap, pour ainsi dire : elle cessera d'être une force de haute mer pour devenir capable de mener des opérations dans la zone littorale, c'est-à-dire dans des eaux moins profondes et risquant d'être plus dangereuses. Au cours de l'opération exécutée en Somalie, par exemple, un de ses pétroliers ravitailleurs d'escadre a appuyé le contingent canadien à terre. Cela dit, la Force maritime ne possède aucun des grands moyens nécessaires pour projeter sur terre sa puissance navale, par exemple des missiles de croisière d'attaque d'objectifs terrestres, ces engins ayant montré leur utilité pendant les missions d'imposition de la paix en Bosnie (1995) et au Kosovo (1999). Certes, l'acquisition de missiles de croisière américains *Tomahawk* est hors de question à cause du prix, mais le Canada serait sans doute en mesure de se doter de missiles d'attaque terre lancés à distance de sécurité.

CONCLUSION

9. Tandis que le Canada continue de définir la façon dont il abordera la RAM, il aura avantage à prendre en compte certains facteurs contextuels importants. Tout d'abord, le *Livre blanc* de 1994 fait valoir la nécessité d'une force polyvalente capable d'aller au combat et d'exécuter toute une gamme d'opérations, y compris non seulement les missions de maintien de la paix et d'observation, mais aussi celles ayant pour objet de faire respecter la volonté de la communauté internationale et d'assurer la défense collective. Dans le contexte de la RAM, le Canada voudra donc cerner les technologies, doctrines et concepts organisationnels applicables aux opérations de faible *et* de haute intensité, et il voudra investir dans ces éléments. Par exemple, les systèmes perfectionnés de commandement, de contrôle, de renseignement, de surveillance et de reconnaissance sont utiles à la conduite efficace des opérations quelle que soit l'ampleur et l'intensité du conflit. Les véhicules aériens non pilotés de reconnaissance ont fait leurs preuves dans tout un éventail de circonstances, depuis les opérations de haute intensité de la Guerre du Golfe jusqu'à la mission de faible intensité qui consistait à surveiller la paix en Bosnie, en passant par l'opération de moyenne intensité menée par l'OTAN au Kosovo et dans les environs. Les moyens de transport stratégique sont eux aussi des atouts qui se prêtent bien aux

tâches de faible et de haute intensité, tandis que les munitions à guidage de précision sont de toute évidence utiles pour les combats et pour les missions d'imposition de la paix.

10. Sur un plan plus général, pour que les Forces canadiennes participent concrètement à la réalisation des objectifs futurs du Canada au chapitre de la sécurité mondiale, elles devront pouvoir contribuer sensiblement aux opérations des forces de coalition. Cela signifie notamment qu'elles devront conserver et renforcer leur interopérabilité par rapport à leur partenaire le plus probable, soit les forces armées américaines. C'est là tout un défi, car les États-Unis continuent de poursuivre un ambitieux programme visant à adopter des technologies révolutionnaires et à les intégrer à leurs forces armées. Une solution-guide plausible consisterait à élaborer une structure des forces dotée des moyens qui permettraient aux FC de remplir le rôle le plus probable, à savoir exécuter des missions de paix, tout en demeurant capables de s'intégrer aux forces américaines issues de la RAM pour faire face aux situations les plus dangereuses. Mise à part l'interopérabilité, les FC devraient aussi, afin d'apporter une contribution valable, disposer d'effectifs suffisants pour former une force de combat digne de ce nom, et s'assurer en outre que celle-ci peut tenir le coup pendant une période raisonnable.

11. Enfin, tandis que le Canada définit peu à peu sa position face à la RAM, il aura sans doute avantage à y voir aussi bien *un nouvel horizon* qu'*un défi* à relever. La nature de la RAM est telle qu'elle modifie les éléments fondamentaux du potentiel militaire d'un pays. Autrefois, la population d'un pays et la taille de son économie étaient déterminants à cet égard; or, de plus en plus, ce qui compte, c'est la qualité de ses forces permanentes et de son secteur de la technologie de pointe. Pareille évolution a des conséquences importantes pour le Canada et pour la capacité de ses forces armées d'aider à réaliser les objectifs de sa politique étrangère et de sa politique en matière de sécurité. À l'ère industrielle, il fallait une armée nombreuse et massive, ce qui dépassait les capacités du Canada, mais à l'ère de l'information, c'est d'une force bien dotée sur le plan technologique qu'il faut disposer : or, c'est là un objectif nettement à la portée du Canada.

EXECUTIVE SUMMARY

INTRODUCTION

1. One of the most important trends that will affect Canada's security and defence policy over the next two decades is the Revolution in Military Affairs (RMA). This term refers to a major change in the nature of warfare brought about by advances in military technology which, combined with dramatic changes in military doctrine and organisational concepts, fundamentally alter the character and conduct of military operations.

2. Key technological, doctrinal and organisational changes associated with the RMA include, but are not limited to, the following elements:

Technology

- The application of precision force by launching precision-guided munitions;
- Achieving enhanced "battlespace awareness" with advanced intelligence gathering, surveillance and reconnaissance assets. These may include surveillance aircraft, unmanned aerial vehicles and satellites; and
- Advanced command, control, communications, computers and intelligence processing capabilities.

Doctrine

- Operations characterised by navies, armies and air forces (and in some cases the Marines) increasingly working together, i.e. "jointness," and by militaries of different countries operating in coalition, i.e. "combined" operations, making interoperability among services and militaries especially important;
- More rapidly mobile and flexible ground forces that, while smaller, are still highly lethal;

- A long-term move away from manned aircraft to unmanned aircraft, especially for reconnaissance but also increasingly for combat; and
- A change in focus from warfare at sea to naval forces projecting power from the sea onto land in the context of littoral warfare.

Organisation

- Smaller, more modular units that can be easily combined and tailored to specific tasks;
- More decentralised decision-making as a result of increased situational awareness and battlespace control capabilities at lower echelons than was previously the case; and
- A move towards professional forces and more highly educated service personnel.

POLICY STATEMENTS AND VISIONS

3. Although the Department of National Defence (DND) and the Canadian Forces (CF) have been aware for several years of the dramatic advances in technologies that are "revolutionizing" warfare, they have only relatively recently begun to focus their attention on the RMA *in its entirety*, and its implications for Canada. Work on this issue in DND's Directorate of Strategic Analysis in 1997 and 1998 provided part of the impetus for the Defence Management Committee's direction, in May 1998, that the Department develop a Canadian perspective on the RMA. DND has responded to this imperative with two high-level conferences. *Canadian Defence Beyond 2010* (November/December 1998) focused on the impact of the RMA on various CF and departmental activities, while *Creating the Canadian Forces of 2020* (April 2000) looked at concept development and experimentation, and the integration of modeling and simulation across DND and the CF.

4. Beginning in 1997, some of the vision statements of the Canadian military services began referring to the RMA. *Adjusting Course: A Naval Strategy for Canada* (April 1997) discusses many of the technological elements of the RMA and some of the doctrinal and organisational implications, as does *Canada's Army* (April 1998). Beyond the individual services, some more

recent DND-wide defence policy documents discuss RMA-related technologies and concepts, including *Shaping the Future of the Canadian Forces: A Strategy for 2020* (June 1999) and *Defence Planning Guidance 2000* (August 1999).

CONCRETE MEASURES IN RESPONSE TO THE RMA

5. The Canadian Forces has already undertaken some limited measures that are consistent with the RMA's advanced technologies. DND is acquiring its first dedicated military satellite communications capability, the Air Force has equipped its CF-18s with the capability to conduct precision strike missions, the Army is in the process of "digitizing" the battlefield, and the Navy has upgraded the satellite communications systems on its Iroquois-class destroyers. Notable gaps in the Canadian military's RMA technologies include satellite-guided precision systems, enhanced battlespace awareness capabilities such as operational and strategic unmanned aerial vehicles, and land attack missiles for sea power projection onto land. During international military operations Canada, like many of its allies, is almost entirely dependent on the United States for these capabilities.

6. Canada has also begun to take some steps that are consistent with the doctrinal and organisational trends of the RMA. To increase the CF's "jointness", 1 Canadian Division in Kingston has been amalgamated with the Joint Force Headquarters to create the Canadian Joint Force Headquarters, a deployable command and control organisation capable of national command and logistic support at the operational level of war. Jointness is also being promoted through exercises such as the bi-annual Maritime Co-ordinated Operational Training (MARCOT) exercises, which incorporate elements of all three of Canada's services. Canada's Army is also undertaking to transform the land forces into the Army of Tomorrow, a force that will be optimised for expeditionary operations using precision weapons, modular units and lighter more mobile equipment. To this end, the army is in the process of rationalising its fleet of armoured fighting vehicles, and shifting the balance from tracked to wheeled vehicles.

7. In addition, in January 2000 the Minister announced the CF's intention to establish a combat-ready strike force ready to respond rapidly to global crises in the context of NATO or UN mandated missions. Central to achieving this capability will be strategic lift, an area where the CF has only limited resources. Its Hercules and Polaris aircraft are often overworked, and the CF has no dedicated sea lift assets. DND has begun studies to determine the CF's future strategic lift requirements, one element of which will likely be an Afloat Logistics and Sealift Capability that will combine capabilities for fleet replenishment at sea, in-theatre support to joint forces ashore, and strategic lift for the army.

8. Canada has not made any concrete moves towards a third RMA doctrinal area of unmanned combat using unmanned combat aerial vehicles. This is not surprising, considering that the 1994 Defence White Paper explicitly stated that Canada would not seek a full range of capabilities. To date the focus of attention has been on updating our manned fighters, the CF-18, and looking at future options for new manned fighters, such as America's Joint Strike Fighter. Finally, Canada's navy has begun to change its focus from being a "blue-water" open ocean force, to one that can also conduct littoral operations in shallower, potentially more dangerous waters. During the Somalia operation, for example, one of the Navy's Auxiliary Oiler Replenishment ships supported the Canadian contingent ashore. That said, the navy has none of the major tools for sea power projection onto land, like the land attack cruise missiles that proved so useful during the peace enforcement missions in Bosnia (1995) and Kosovo (1999). While America's *Tomahawk* cruise missile is considered out of the question due to cost, a feasible option for Canada may be the Standoff Land Attack Missile.

CONCLUSION

9. As Canada continues to develop its approach to the RMA, it may want to bear in mind some important contextual factors. First, the 1994 White Paper argues for a multi-purpose, combat capable force that can respond to a range of operations, including not only peacekeeping and observer missions, but also enforcing the will of the international community and collective defence. It follows that Canada will want to identify and invest in those RMA technologies, doctrines and organizational concepts that are applicable to both low *and* high intensity

operations. Advanced command and control and intelligence, surveillance and reconnaissance systems, for example, are relevant to the efficient conduct of operations at all points along the spectrum of conflict. Unmanned aerial vehicles for reconnaissance have proved their worth in a range of conflict scenarios, from the high-intensity battlefield of the Gulf War, to the medium-intensity NATO operation in and around Kosovo, to the low-intensity task of monitoring the peace in Bosnia. Strategic lift is another good example of a capability that is suited to both high and low intensity tasks, while precision-guided munitions are clearly relevant both to warfighting scenarios and to the peace enforcement aspects of peace support operations.

10. More broadly speaking, if the Canadian Forces is to concretely support the achievement of Canada's future global security objectives it will need to be able to make a meaningful contribution to coalition operations. In part this means maintaining and enhancing interoperability between the Canadian Forces and its most likely coalition partner, the United States Military. This will be no small undertaking as the United States continues to pursue an ambitious program of developing and integrating revolutionary technologies into its military forces. A plausible guiding framework may be to develop a force structure that reflects suitable capability for the most likely forms of employment, peace support operations, while retaining the ability to integrate into the RMA forces of the United States to confront the most dangerous contingencies. Beyond interoperability, making a meaningful contribution also involves maintaining a sufficient number of forces to form a combat relevant force, and ensuring that those forces are sustainable.

11. Finally, as Canada moves forward with its response to the RMA it may want to view the phenomenon as much as an *opportunity* as a *challenge*. The nature of the RMA is such that it is changing the most important elements of a country's military potential. Whereas the determining factors used to be a country's population and the size of its economy, increasingly they are the quality of its standing forces and of its high-tech sector. Such a shift has important implications for Canada and the ability of the Canadian Forces to support Canadian foreign and security policy objectives. While the large, mass army of the Industrial era was not a feasible option for Canada, the smaller, more technologically capable force of the Information Age is well within its reach.

CANADA AND THE REVOLUTION IN MILITARY AFFAIRS

INTRODUCTION

1. One of the most important trends that will affect Canada's security and defence policy over the next two decades is the Revolution in Military Affairs (RMA). This term refers to *a major change in the nature of warfare brought about by advances in military technology which, combined with dramatic changes in military doctrine and organisational concepts, fundamentally alter the character and conduct of military operations.*[1] Significantly, advances in military technologies do not in themselves constitute an RMA; rather, a "revolution" requires that new technologies lead to, or become reflected in, dramatic doctrinal and organisational change.

Historical context

2. Military historians are quick to note that there have been many revolutions in military affairs over the course of history. They point, for example, to the *Infantry Revolution* of the 14th century, which was fuelled by the "technological" development of the longbow and led to the doctrinal innovation of integrating archers with dismounted men-at-arms; the *Napoleonic Revolution*, which integrated large mass armies (stemming from the French Revolution's *lévee en masse*) with the technological advances of the Industrial Revolution; and the *Interwar Revolution in Mechanisation*, which made possible the Panzer division and a new generation of combat aircraft that led directly to the revolutionary air-ground doctrine later dubbed *blitzkrieg*.[2]

3. Historians also place RMAs in the context of the wider phenomenon of Military Revolutions. These, they argue, not only fundamentally change the character of warfare, but also

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[1] This is commonly accepted definition that was advanced by Andrew Marshall, Director of the Pentagon's Office of Net Assessment, in 1993.

[2] See Andrew F. Krepinevich, "Cavalry to Computer: The Pattern of Military Revolutions," *The National Interest* (Fall 1994): 30-42. Krepinevich argues that there have been at least ten RMAs since the 14th century.

"recast the nature of society and the state."[3] The *Artillery Revolution* forced the battle from the fortress to the field, giving the advantage to powers with the resources to maintain large, powerful armies and eventually leading to the emergence of centrally governed nation-states with standing armies. The *Napoleonic Revolution*, with its large citizen army equipped with standardised weapons, reflected a change that was already underway in the civilian world of moving from an agricultural economy to the mass production of the Industrial Revolution. Similarly, the knowledge-based information society that started to emerge in the early 1970s began in the 1980s to be increasingly reflected in computerised, digitised warfare.[4]

4. Some analysts and historians have made the case that the current RMA reflects not so much *revolutionary* change as *evolutionary* developments.[5] They note, for example, that precision-guided munitions, a technology that is central to the current RMA, were first introduced almost thirty years ago, during the Vietnam War. Others argue that the fact that a significant advance in technology has been available for some time is a moot point. Revolutions in military affairs can take years if not decades to come to fruition, especially during peace time, and the important factor to consider is whether or not that particular technology ultimately brings about dramatic changes in military doctrine and organisation.

Today's revolution

5. Bearing this in mind, it may be useful to focus here not so much on whether or not there is a revolution or evolution in progress, but rather on changes that are already underway in the nature of warfare, or that could potentially take place over the next two decades, and then try to determine what they might mean for Canada's security and defence efforts.

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[3] Williamson Murray, "Thinking About Revolutions in Military Affairs," *Joint Forces Quarterly* (Summer 1997), p. 71.

[4] See Alvin and Heidi Toffler, *War and Anti-War* (New York, NY: Warner Books, 1993).

[5] See for example Lawrence Freedman, *The Revolution in Strategic Affairs* (London: IISS Adelphi Paper No. 318, April 1998) or Michael O'Hanlon, "Can High Technology Bring US Troops Home?" *Foreign Policy* (Winter 1998/99).

6. Key technological, doctrinal and organisational changes associated with today's RMA include, but are not limited to, the following elements:[6]

Technology

- The application of precision force by launching precision-guided munitions;
- Achieving enhanced "battlespace awareness" with advanced intelligence gathering, surveillance and reconnaissance (ISR) assets. These may include advanced surveillance aircraft, unmanned aerial vehicles (UAVs) and satellites;
- Advanced command, control, communications, computers and intelligence processing (C4I) capabilities; and
- Increased power projection and strategic/operational/tactical surprise as a result of low observable or "stealth" technologies, such as nanotechnology or microminiaturisation.

Doctrine

- Operations characterised by navies, armies and air forces (and in some cases the Marines) increasingly working together, i.e. "jointness," and by militaries of different countries operating in coalition, i.e. "combined" operations, making interoperability among services and militaries especially important;
- More rapidly mobile and flexible ground forces that, while smaller, are still highly lethal;
- A long-term move away from manned aircraft to unmanned aircraft, especially for reconnaissance but also increasingly for combat; and
- A change in focus from warfare at sea to naval forces projecting power from the sea onto land in the context of littoral warfare.

[6] For a more detailed discussion of the key elements of the Revolution in Military Affairs please see Elinor C. Sloan, *The United States and the Revolution in Military Affairs* (D Strat A Project Report No. 98/01, February 1998).

Organisation

- Smaller, more modular units that can be easily combined and tailored to specific tasks;
- More decentralised decision-making as a result of increased situational awareness and battlespace control capabilities at lower echelons than was previously the case; and
- A move towards professional forces and more highly educated service personnel.

7. Although the current RMA is a US-led phenomenon, many of Canada's closest allies are already developing their own approaches and responses. Britain, France, Germany and Australia are all, to varying degrees, focusing on creating an expeditionary capability that integrates smaller, more mobile forces with precision firepower, digitalization and strategic lift. Unmanned aerial vehicles are seen as a key technology for the future, as are satellites for enhanced battlespace awareness and control. Increased jointness among services, combinedness among national militaries, and interoperability to facilitate both, are receiving significant doctrinal emphasis.[7]

8. This paper discusses Canada and the Revolution in Military Affairs. It looks at the extent to which the concept is reflected in current Canadian defence policy, and examines measures Canada is taking in the key technological and doctrinal/organisational areas of the RMA. It concludes by outlining some important contextual factors that may be useful to bear in mind as policy-makers continue to frame Canada's response to the challenges and opportunities presented by the RMA.

POLICY STATEMENTS AND VISIONS

9. The Department of National Defence (DND) and the Canadian Forces (CF) have been aware for several years of the dramatic advances in military technologies that are

[7] For a more detailed discussion of how Britain, France, Germany and Australia are responding to the Revolution in Military Affairs please see Elinor C. Sloan, *Allied Approaches to the Revolution in Military Affairs: Britain, France, Germany and Australia* (D Strat A Project Report No. 99/03, February 1999).

"revolutionizing" warfare. An in-depth examination of new technologies formed part of the 1994 Defence White Paper process,[8] and the White Paper's stated objective of having armed forces that can fight "alongside the best, against the best" is an implicit reference to advanced capabilities.[9]

10. Nonetheless, DND and the CF have only relatively recently begun to focus their attention on the RMA *in its entirety*, and its implications for Canada. Work on this issue in DND's Directorate of Strategic Analysis in 1997 and 1998 provided part of the impetus for the Defence Management Committee's direction, in May 1998, that the Department develop a Canadian perspective on the RMA. DND has already responded to this imperative with two high-level conferences. *Canadian Defence Beyond 2010* (November/December 1998) focused on the impact of the RMA on various CF and departmental activities, including operations, science and technology, materiel, human resources and the defence industry. A detailed *RMA Concept Paper* (May 1999) set out key conclusions and recommendations, one of which was to examine the tools for implementing the RMA. Accordingly, *Creating the Canadian Forces of 2020* (April 2000) looked at concept development and experimentation, and the integration of modeling and simulation across DND and the CF, to determine how they can best be used to validate future force structure. Conclusions and recommendations are to be captured in a Fall 2000 conference report.

11. These concrete efforts to examine the RMA and methods of implementing it have been coupled with the support of high-level departmental officials. The Minister of National Defence, Art Eggleton, has called the RMA a significant challenge that Canada "must face," and stated that our efforts should begin with a "concerted and cohesive study of the RMA."[10] General Maurice Baril, Chief of the Defence Staff, has gone into more detail, arguing that we must focus our attention on RMA developments that help us implement our defence policy, and suggesting that some of the key areas may be combinedness, jointness and interoperability.[11]

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[8] Comments from Dr. Roman Jakubow, Director Strategic Analysis, 31 March 2000.

[9] *1994 Defence White Paper*, p. 14.

[10] Keynote address to the Symposium on Canadian Defence Beyond 2010, Government Conference Centre, Ottawa, 30 November 1998.

[11] Speech to the Canadian Forces Command and Staff College, Toronto, 26 May 1999.

12. Canada's relatively recent focus on the RMA is reflected in the evolution of its official defence policy statements. The 1994 *Defence White Paper* makes no mention of the Revolution in Military Affairs. This is perhaps not surprising since even in the United States, which has been at the forefront of thinking about the changing nature of warfare, RMA technologies, doctrines and concepts did not figure extensively in an official defence policy statement until *Joint Vision 2010* was released in June 1996. The term "revolution in military affairs" itself did not appear in an official US defence policy document until the May 1997 *Quadrennial Defense Review*.

13. Beginning in 1997, some of the vision statements of the Canadian military services began referring to the RMA. *Adjusting Course: A Naval Strategy for Canada* (April 1997) discusses many of the technological elements of the RMA, including improved sensors, more rapid transmission of information, stealth and precision force. It also looks at the likely organisational effects of these technologies, such as the need for people with new skill sets, and the requirement to redefine traditional command and control arrangements.[12] *Canada's Army* (April 1998) briefly mentions the RMA, some of its technological aspects, and the fact that the RMA will influence how armies of the future will be trained, organised and equipped.[13] It discusses doctrinal trends towards increased joint and combined operations and the dispersion of forces on the battlefield, and notes that RMA technologies will necessitate changes in military organisations and command and control structures.[14]

14. Beyond the individual services, several DND-wide defence policy documents discuss RMA-related technologies and concepts. *Shaping the Future of the Canadian Forces: A Strategy for 2020* (June 1999) outlines a number of themes that will guide the future strategic direction of the Canadian Forces. They include an increased focus on jointness, ensuring Canadian forces are interoperable with US forces and capable of combined operations, and developing a force structure that is more rapidly deployable to crisis spots around the world—all of which figure as elements of the RMA. *Defence Planning Guidance 2000* (August 1999) reflects *CF 2020*'s

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[12] *Adjusting Course: A Naval Strategy for Canada*, April 1997, pp. 21-24.
[13] *Canada's Army*, Canadian Forces Publication B-GL-300-000/FP-000, April 1998, p. 113.
[14] *Canada's Army*, pp. 117-119.

vision and speaks of the "challenge of the Revolution in Military Affairs." It outlines a number of change objectives, such as targeting leading edge technologies and doctrines, enhancing deployability, and strengthening interoperability, that are consistent with the RMA. A closer look at these technologies and doctrines, and the Canadian response to date, is set out below.

CONCRETE MEASURES IN RESPONSE TO THE RMA

RMA Technology

15. *Precision force and precision-guided munitions.* The CF has already invested in, or has plans to acquire, a number of RMA-related technologies. Most visible in recent operations has been the CF's assets in the area of precision force and precision guided munitions (PGMs). In 1996 the Air Force began equipping a number of its CF-18 *Hornet* fighter aircraft with the capability to conduct precision bombing, installing infrared sensors that allow pilots to see targets at night, and laser designators which enable them to guide precision weapons to their target.[15] The Air Force also took delivery of its first PGMs, which included GPU-10 and GPU-12 laser-guided bombs purchased from the United States. These measures meant that Canada was in a good position to take part in NATO's Operation "Allied Force" in and around Kosovo in the spring of 1999. Canadian fighters flew 678 combat sorties during the Kosovo campaign, dropping 120 and 240 GPU-10 and GPU-12 precision-guided bombs respectively, and 171 Mk 82 "dumb" bombs.[16]

16. The successful use of precision munitions in the Kosovo air campaign has prompted Canada to take steps to increase its PGM inventory. The Air Force has plans in place to draw down its Mk 82 stocks while purchasing additional GPU-10 and GPU-12 munitions, as well as possibly the GBU-16 laser guided bomb.[17] In addition, problems with the weather during the Kosovo campaign have prompted Canada to examine the acquisition of precision munitions that

[15] Air Force Facts & Stats, http://www.airforce.dnd.ca/eng/equip1m.htm

[16] David Pugliese, "Performance in Kosovo Prompts Canada to Buy More Smart Bombs for Air Force," *Defence News*, 29 November 1999, p. 13.

are guided by the Global Positioning Satellite (GPS) navigation system. While laser-guided systems are reliant on clear skies to allow a laser "lock" on a target, GPS-guided systems can "see" through the clouds and thus have an all-weather capability. The US Air Force recently announced that it would not be procuring any more laser-guided weapons because of their weather limitations.[18] Canada's Air Force has no immediate plans in place to acquire GPS-guided precision systems,[19] but if it should do so in the future, one option may be the Joint Direct Attack Munition, a relatively inexpensive GPS-guided system that was proven very effective during the Kosovo campaign.

17. *Battlespace control and advanced C4I.* Canada is also investing in advanced command, control, communications, computers and intelligence processing (C4I) capabilities. At the strategic level, DND is acquiring its first dedicated military satellite communications capability. Currently, Canada relies on rental agreements with commercial satellites for long-range military communications. Under a Memorandum of Understanding with the United States, Canada will participate in the advanced EHF satellite system, which is to have an initial operating capability in 2006, with four satellites up and running by 2008.[20] Canada will also develop its own dedicated, military communications system to be flown on the satellites it chooses. Not only will the system provide secure data and voice communications for Canadian forces units world wide but, by choosing to pursue a capability in an American system, Canada is ensuring future interoperability with the United States.[21]

18. Meanwhile, the Canadian Army is taking a number of measures to "digitise" the battlefield. The Iris Tactical Command, Control and Communications System, comprised of hand-held and vehicle mounted radios operating in several frequency bands, will provide the Army with a secure and reliable communications system that can be integrated with a number of sub-systems. These include the Situation Awareness sub-System, which will permit vehicle and

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[17] Ibid.

[18] Comments from Major Paige Cutland, Directorate Air Strategic Plans, 20 March 2000.

[19] Sharon Hobson, "Canada Country Briefing: Stretching to the Limits," *Jane's Defence Weekly*, 2 February 2000, p. 30.

[20] Colonel Dennis Harris, as quoted in "Canada to Participate in US Satellite Project," *Jane's Defence Weekly*, 6 October 1999, p. 4.

unit commanders to know where all unit and enemy vehicles are with pinpoint accuracy day or night and in any weather.[22]

19. The Army's digitisation program also includes a two-tier battlefield management system known as the Land Forces Command System. The battalion-and-above *Athene* battlefield management system automates such tasks as analysing terrain, processing and creating messages and updating maps, and will keep battlefield commanders supplied with up-to-the-minute information.[23] Based on a system currently in use by the French Army, *Athene* is being Canadianized and connected to the Iris communication system. In the future, the Army also hopes to acquire a "foxhole-to-battalion" battlefield management system, known as Position Determination and Navigation for the Land Forces, that will provide the smaller combat units on the battlefield with the same type of tactical information as the *Athene* system gives brigade group headquarters officers.[24] The ISTAR (intelligence, surveillance, target acquisition and reconnaissance) project, launched in the fall of 1999, will design an architecture to integrate all of these sensing, analysis and transmitting technologies.[25]

20. The Canadian Navy has arguably been at the forefront of advanced C4I capabilities in the Canadian Forces for several years. "The current Canadian vision of the Army describes battle space awareness and C4I, but the Canadian Navy is already employing these aspects. In near and real time, we fuse information from a wide range of sources, developing a single coherent picture that is then shared amongst the fleet and with others."[26] Building on this, the Navy has taken steps to improve its ability to control the battlespace, for instance by upgrading the satellite communications systems on its Iroquois-class *Trump* destroyers. [27] During Operation Allied

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[21] David Pugliese, "Canada Pursues First Dedicated Military Satcom System," *Defense News*, 18-24 May 1998, p. 18.

[22] Paul Mooney, "Into the Digital Age With TCCCS," *Maple Leaf*, 30 June 1999.

[23] "Athene Will Put Canadian Army in Command," *Jane's Defence Weekly*, 4 March 1998, p. 7.

[24] "Canadian Contender Enters the Fray for UK Digitalization Program," *International Defense Review*, 1 February 1999 and *The Ottawa Citizen Online*, "High Tech Supplement," 7 October 1998.

[25] Paul Mooney, "Seeing and Sensing on Tomorrow's Battlefield," *Maple Leaf*, 2 February 2000.

[26] Commander Kelly Williams, "The Canadian Navy: Ready and Relevant," in Shaye K. Friesen, ed., *Transforming an Army: Land Warfare Capabilities for the Future Army* (Kingston, ON: Directorate Land Strategic Concepts, July 1999), p. 116.

[27] Sharon Hobson and Joris Janssen Lok, "Canadian Navy Moves to Fill C4I Gap," *Jane's International Defense Review*, 1 June 1999.

Force this measure was cited by our allies as "the best example yet of a small navy adapting to a large task" because it gave the Canadian Navy both "information on demand" (real-time information) and "a high degree of communications and interoperability fit" (interoperability) with our allies.[28]

21. *Battlespace awareness and advanced ISR.* A notable capability gap in the Canadian military's RMA technologies is in operational and strategic intelligence gathering, surveillance and reconnaissance capabilities. Whereas Canada's allies, including not only the United States but also Britain, France and Germany, are developing and fielding unmanned aerial vehicles for tactical and strategic ISR, Canada has deferred the funds available for an Unmanned Aerial Surveillance Target Acquisition System.[29] As the same time, in terms of manned surveillance aircraft, Canada has no equivalent to the American JSTARS or the planned British ASTOR airborne ground surveillance systems. And although RADARSAT I provides high-resolution satellite imagery of the ground, Canada does not have any similar military satellite surveillance system. The combination of all these factors means that in any operation, Canada, like many of our NATO allies, is almost entirely dependent on the United States for its intelligence collecting, surveillance and reconnaissance information.

22. That said, Canada could be expected to participate in any future NATO airborne ground surveillance system, just as CF personnel are regular members of the crews aboard NATO's AWACS airborne air surveillance aircraft. In addition, the Aurora Incremental Modernisation Project Statement of Requirement includes a Ground Moving Target Indication capability, an upgrade that "will give the platform a significant and interoperable ISR capability over land."[30] A third point is that Canada, like other nations, has access to the GPS, which has dramatically increased precision in all aspects of military operations, from targeting stand-off munitions to tracking logistics supplies around the world. Finally, by virtue of its close bilateral defence co-operation with the United States through the North American Aerospace Defence Agreement

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[28] Message from Rear-Admiral D. Morse, Commander Standing Naval Force Atlantic, 28 March 2000.
[29] "Army Regrouping in Face of Cuts," *Jane's Defence Weekly*, 2 February 2000, p. 29.
[30] Cutland, 20 March 2000.

(NORAD), Canada has access to an enviable amount of US intelligence information and in fact processes 10% of all US satellite imagery.[31]

RMA doctrine and organisational changes

23. *Jointness and combinedness.* Canada is also taking measures that are consistent with the RMA's key doctrines, some of which are engendering important organisational changes. For example, Canada has recently begun to take concrete steps to increase the "jointness" of its forces. This concept refers to "the art of combining capabilities from the different military services to create an effect that is greater than the sum of the parts."[32] Here the Canadian Forces is building on more than three decades of service integration. As a result of amendments to the National Defence Act in 1964, the Service Chiefs of Staff were replaced with a single Chief of Defence Staff, with executive authority over the three services. Additional changes in 1967 integrated the logistics, supply and, to a certain extent, training systems, bringing a measure of rationalisation and economy of forces. Unification the following year abolished the three services and created the Canadian Forces.[33] By taking these measures, and notably by making a single Deputy Chief of Defence Staff responsible for the strategic direction of Canadian Forces operations, Canada was well ahead of its allies in creating some of the key elements of a Joint Force.[34] Indeed, in many ways, current allied efforts to promote joint doctrine are designed to match the support aspects of the Canadian Forces' integrated and unified system.[35]

24. Despite these steps, until recently "unification was, for various reasons, institutional and bureaucratic, but not operational."[36] In this context it is useful to make a distinction among three "levels" of jointness: joint support and training, joint operations, and joint force planning.[37] The steps taken in the late 1960's to a large extent achieved the goal of joint support and training.

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[31] Conversation with Vice-Admiral James King, Canadian Military Representative to NATO, 29 March 2000.

[32] Definition used by the US Joint Forces Command, Norfolk, VA.

[33] Lieutenant-Colonel F.M. Boomer, "Joint or Combined Doctrine?: the Right Choice for Canada," paper submitted to the Advanced Military Studies Course, Canadian Forces Command and Staff College, Toronto, 1998.

[34] King, 11 February 2000.

[35] Boomer.

[36] Jeremy Stocker, "Canadian 'Jointery'," *Joint Forces Quarterly* (Winter 1995/96), p. 117.

[37] King, 11 February 2000.

Actual operations, however, continued to be conducted along traditional service lines, essentially in isolation from one another. Maritime Command focused its efforts on protecting the sea lines of communication in the North Atlantic, Land Forces Command was primarily committed to the central front in Germany, and Air Command played a major role within NORAD. Even when it came to Canada's speciality during the Cold War, peacekeeping operations, the services tended to work separately, with contributions normally coming from one service. The nature of their primary tasks meant that the Canadian Navy and Air Force worked extensively with their US counterparts during the Cold War, while the Canadian Army worked with that of Germany. These patterns have meant that the Navy and Air Force find themselves today somewhat more interoperable with the US military than does the Army, and that Canada has gained far more experience in combined than joint operations.

25. This is not to say that the services did not ever work together during the Cold War. The Maritime Air Group that participated in the Navy's anti-submarine role was part of Air Command, as were the Army's supporting helicopter and air transport elements. Today these Air Force assets are part of 1 Canadian Air Division. These practical arrangements make apparent the potential of integration and unification to bring about jointness in operations: "In most other navies, the maritime air element is an integral element of that navy. In most other armies, the helicopter element of a Brigade Group is an integral element of that army. Such examples demonstrate that, in Canada, jointness already exists to a large degree."[38] The Maritime Air element, in particular, was (and continues to be) "an excellent example of jointness, with the Air Force and Navy working together since 1964."[39] As for joint force planning, although there is an organisation within National Defence Headquarters that overseas force planning, much of it is still done by the individual services.

26. Over the past few years the Canadian Forces has increasingly incorporated jointness into its overall concept of operations. The 1994 *Defence White Paper* called for the CF to be able to deploy a joint task force headquarters as part of a multilateral operation anywhere in the world, or in defence of a NATO member state. In response, it created a standing core of a deployable

[38] Boomer.
[39] Comments from Commander Chris Gunn, Directorate of Maritime Strategy, 12 April 2000.

Joint Force Headquarters (JHFQ). In the event of a crises the headquarters, based on the headquarters of the 1st Canadian Division in Kingston, Ontario, would be augmented with appropriate cross-environmental staff.[40] In a combat situation the JFHQ would exercise national command functions over the Canadian contingent and, depending on the situation, perhaps operational command over the forces of other countries, while in a peacekeeping situation the JFHQ could, in principle, become the core of a multilateral operation.

27. That said, Canada's attempt to lead a humanitarian relief operation in Africa's Great Lakes region in 1996, which was later abandoned due to changing circumstances, demonstrated the CF's limited capabilities to actually mount, deploy and employ a Joint Task Force.[41] To address this evident shortfall the CF is taking a number of measures, including the amalgamation on 1 June 2000 of the Joint Force Headquarters with the 1st Canadian Division to create the Canadian Joint Force Headquarters. DPG 2000 states the objective of completing "the conversion of the Joint Force Headquarters to a deployable C4I organisation capable of national command and logistic support at the operational level of war."[42]

28. The Canadian Forces is also focusing increasingly on jointness in its training exercises. A good example is the Maritime Co-ordinated Operational Training (MARCOT) exercises held annually or biannually off the East or West Coast of Canada. In recent years, MARCOT has incorporated elements of all three of Canada's services, allowing them to practice their abilities to function co-operatively in a realistic international scenario. MARCOT normally includes forces from several other NATO countries. In day to day operations the services are also taking measures to enhance their ability to work together. For example, each of the CF environments contribute to and benefit from employment at NORAD Headquarters where, by the end of summer 2000, the Navy and Army will have 10 and 8 personnel respectively.[43]

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[40] Stocker, p. 117.

[41] Joseph T. Jockel, *The Canadian Forces: Hard Choices, Soft Power* (Toronto: Canadian Institute of International Affairs, 1999), p. 60.

[42] DPG 2000, p. 2-7.

[43] Lieutenant-Colonel Paul Ward, Directorate Land Strategic Planning, 28 March 2000.

29. The past few years have seen some limited examples of actual CF joint operations. During the operation in Somalia, an Auxiliary Oiler Replenishment (AOR) ship supported the Canadian contingent by providing sealift from Canada for military equipment and supplies, and by acting as a floating headquarters.[44] More recently, both the Air Force and to lesser extent the Navy have worked with the Army in operations at the lower end of the operational intensity spectrum, such as *Op Assistance*, CF support to Manitoba during the 1997 Red River Flood, and *Op Recuperation*, CF support to Ontario and Quebec during the 1998 Ice Storm. That said, such involvement has usually been in a facilitating role rather than as an actual joint operation.[45]

30. Canada's response to the RMA's doctrinal trends of increased jointness and combined operations must be tempered by its particular needs and role in the world. The fact that the United States is moving towards a joint force structure may or may not be applicable to Canada, depending on the situation. For domestic operations it is important that our services be able to work together. For overseas missions, however, it is almost inconceivable that Canada would operate on its own. "Our contributions to a coalition will take the form of tactical injections to the various components—we will not present a neat joint tactical package. Our CF-18s will bomb strategic targets, our frigates will work with Carrier Battle Groups, and our brigade will fight with an allied corps/division."[46] In these situations it will far more important that its services focus on their ability to work with their Allied, especially US, counterparts.

31. *Interoperability*. Central to the move towards increased jointness at the national level and combined operations at the international level, is the concept of interoperability. This term refers to "the ability of systems, units and forces to provide services to and accept services from other systems, units or forces and to use these services to enable them to operate effectively together."[47] Within Canada, the three elements of the Canadian Forces are improving their ability to work together. They are, for example, adopting a command and control capacity that links the

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[44] Jockel, p. 73.

[45] Captain (N) J.S. Dewar, "Revolution in Military Affairs: The Divergence Between the Most Dangerous and the Most Likely," paper submitted to the Advanced Military Studies Course, Canadian Forces Command and Staff College, Toronto, 1998.

[46] Lieutenant-Colonel Mike Cessford, Directorate Land Strategic Concepts, email to author dated 27 March 2000.

[47] Klaus Naumann, "From Cooperation to Interoperability," *NATO Review* (July 1996), p. 17.

Army, Navy and Air Force information systems with the National Defence Operations Centre at National Defence Headquarters. The Joint Command and Control Intelligence System uses the same software, terminals, protocols and security features across the services and is expected to be in place by 2003.[48]

32. At the same time, all three of Canada's services are taking steps to enhance their ability to work with the militaries of our NATO allies, particularly the United States. Generally speaking, all investments in new technology are made with a view to ensuring interoperability in a multilateral context. The Navy's satellite communications system upgrade program is meant to address interoperability problems created by the marked C4I gap, made apparent in recent NATO exercises, between the US Navy and its allied counterparts.[49] The Incremental Modernisation Program for the CF-18 is aimed at improving the fighter's interoperability with other forces through, for example, installing the type of radios commonly used by Canada's allies and making hardware system upgrades that are also consistent with allies.[50] And the Army's Iris Tactical Command, Control and Communications System will be fully interoperable with NATO command and control systems. More broadly speaking, the Canadian Forces participates in NATO's longstanding standardisation programs, which have as their goal multilateral standardisation and interoperability of equipment, concepts and doctrine, and in NATO's more recent Defence Capabilities Initiative, which focuses explicitly on improving interoperability among Allied forces.

33. Doctrinally, the Navy already has a high level of interoperability with other NATO navies, especially the US Navy, and this has made it particularly well suited for playing a supporting role, such as sea control, within a multilateral coalition.[51] The Air Force has worked closely with its US counterpart through NORAD over many decades, and has recently turned its attention to ensuring its forces are capable of integrating "as seamlessly as possible" into America's new Air Expeditionary Forces.[52] On a practical level, Canada's fighter aircraft were

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[48] David Pugliese, "Canadians Will Link Service Info Systems," *Defense News*, 28 September 1998.
[49] Hobson and Lok, 1 June 1999.
[50] "Canada's Air Force Abroad," http://www.airforce.dnd.ca/eng/abroad1e.htm
[51] Jockel, p. 87.
[52] *Chief of Air Staff Planning Guidance 2000*, para 28.

interoperable with those of the United States during the Kosovo operation in the spring of 1999. Finally, to enhance interoperability with its US counterpart, Canadian Land Forces have increased its participation in US Army exercises.

34. *More rapidly mobile and flexible ground forces.* Canada is also focusing its attention on creating the rapidly mobile yet still highly lethal ground forces that figure centrally in RMA doctrine. Currently Canada's Land Forces, with 19,000 people organised into three mechanised brigade groups, is not well structured for quick deployment to areas around the world.[53] To address this problem, DPG 2000 directed the Army "to produce a plan by 1 January 2002 for a future land force structure that will be more readily deployable."[54] A key benchmark in the plan will be to encompass the goal, stated in both CF 2020 and DPG 2000, of designing land forces "such that the vanguard and main contingency forces are fully deployable to an offshore theatre of operations within 21 and 90 days respectively, utilising enhanced strategic air and sealift capability."[55]

35. In addition to becoming more globally deployable, the Army must also "modernise." DPG 2000 directs the Army to field a force structure "trained and equipped to generate advanced combat capabilities that target leading-edge doctrine and technologies."[56] To this end, the Land Staff has developed a vision of Canada's Army of Tomorrow. It includes optimisation for expeditionary operations; increased lethality using advanced sensors and precision systems; a modular composition; and optimisation for participation in joint and combined operations—the exact recipe for an RMA ground force.[57]

36. In January 2000 the Minister of National Defence announced the CF's intention to establish "a combat-ready strike force to respond swiftly to global crises to prevent the loss of innocent life and strengthen Canada's influence with its allies."[58] This rapid reaction force is to

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[53] "Army Regrouping in Face of Cuts," *Jane's Defence Weekly*, 2 February 2000, p. 29.
[54] DPG 2000, p. 3-9.
[55] *CF 2020*, p. 10 and DPG 2000, p. 3-9.
[56] DPG 2000, p. 2-6.
[57] 3000-8 (*CLS*), Planning Directive 011/99-Designing the Army of Tomorrow, 6 October 1999, para 9(a).
[58] Robert Fife, "Military Plans Rapid-Reaction Force to Respond to Global Crises," *National Post*, 14 January 2000, p. A1.

involve a battalion (1,000 to 1,200 troops) or one or two battle groups (1,250 to 1,500 soldiers each), respond to NATO or UN mandated missions, and be able to be in action within 30 days of receiving a request for contributions—half the time it normally takes Canada to mount a peacekeeping operation.[59] Depending on the mission, the strike force could include *Coyote* reconnaissance vehicles, *Griffon* helicopters, *LAV III* armoured personnel carriers, *Hercules* transport aircraft (all discussed below), and CF-18 fighter aircraft. Canada's frigates could also be employed, either to conduct patrols or enforce an embargo.[60]

37. Two elements are key to increasing the rapid deployment capability of Canada's ground forces. The first is lighter, more mobile military equipment that still affords troops significant protection and has sufficiently lethal firepower to respond to mid- and high-intensity operational scenarios. To this end, the Canadian Army is in the process of rationalising its fleet of armoured fighting vehicles, and shifting the balance from tracked to wheeled vehicles.[61] Most of the Army's wheeled *Grizzly* Armoured Personnel Carrier (APC) and tracked M113A1 APC, which were designed two and three decades ago respectively, are being phased out and replaced with the third variant of the wheeled Light Armoured Vehicle (LAV III), which is "faster, meaner and better armoured than its predecessors."[62] With its eight oversized tires, the LAV III is more manoeuvrable and will provide increased operational mobility in theatre—attributes that will be relevant to the dispersed, non-linear nature of future military operations.[63] It also comes "fully loaded" with an "impressive array of sighting and laser technology."[64]

38. Meanwhile, the Army has completed accepting delivery of its "state-of-the-art" Coyote reconnaissance and surveillance vehicle. The Coyote can reach a top speed of 120 kilometres per hour and can see as far away as 14 kilometres, maintaining surveillance over a given area in all conditions of darkness and weather.[65] The Army is also planning to acquire a new Armoured Combat Vehicle as a replacement for both the *Cougar* direct-fire support vehicle and the

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[59] Ibid.
[60] Ibid.
[61] Sharon Hobson, "Canada Takes Wheeled AFV Route," *Jane's Defence Weekly*, 24 March 1999.
[62] Lieutenant (Navy) Sue Knight, "Army Takes Delivery of First Lav III's," *Maple Leaf*, 8 September 1999.
[63] Lieutenant-Colonel R.F. Carruthers, "LAV III Provides Improved Capability," *Maple Leaf*, 20 October 1999.
[64] Second-Lieutenant David Dooley, "LAV III Initial Product Testing," *Maple Leaf*, 17 November 1999.

Leopard I main battle tank.[66] Until then, however, the Leopard I has been upgraded with new thermal sights for improved night-fighting capability, and computerised systems for enhanced weapons control. Defence analysts have criticised these expenditures, noting that the main battle tank—a heavy platform with limited battlefield manoeuvrability--is a Cold War relic ill-suited to the requirements of rapid deployment to a theatre, and increased mobility within a theatre.[67]

39. Increased battlefield mobility also depends to a certain extent on helicopters. The CH-146 Griffon, Canada's only land aviation helicopter, is used for everything from airlifts of equipment and troops in theatre and surveillance missions, to search and rescue, medical evacuation, and assistance to civilian authorities.[68] That said, it has a number of limitations. The Auditor General of Canada has criticised the Griffon for its "inadequate lift, limited reconnaissance and lack of communications assistance capabilities."[69] In the area of lift, for example, it cannot transport the Army's new lightweight field howitzer for more than 25 kilometres—short of the Army's original requirement of 100 kilometres. Nor can the Griffon be considered a "combat" helicopter. Canada has never owned an attack helicopter like the US *Apache*, whose chief function is to search and destroy enemy forces, the assumption always having been that such capabilities would be provided by allied units. The Auditor General has concluded that the Griffon would be adequate "in mid-intensity conflict with the support of allies"--the implication being that it would be ill-suited to high-intensity conflict.[70]

40. A second element central to rapid deployment is strategic air and sea lift. For airlift, the Canadian Forces relies on 32 C-130 Hercules and five CC150 *Polaris* (Airbus A310) aircraft. Because of their limited numbers, however, these transports are often overworked and Canada has on occasion had to "piggyback" on American transports, or rent large Russian transport aircraft, to deploy its troops and equipment into theatre. Equally significant is that these aircraft are not large enough to transport some of the Army's "outsized" vehicular cargo, such as the

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[65] Matthew Fisher, "Allies in Kosovo Envy Canada's High-Tech Weaponry," *Maple Leaf*, 14 July 1999.
[66] Sharon Hobson, "Now It's the Army's Turn," *Ottawa Citizen*, 7 October 1998.
[67] David Pugliese, "$140-Million Upgrade Called a Waste," *National Post*, 23 November 1999.
[68] "Aircraft Facts & Stats," http://www.airforce.dnd.ca/eng/equip1c.htm
[69] Sharon Hobson, "Canada's Griffon Helicopter Purchase Brings Mixed Results," *Jane's Defence Weekly*, 26 August 1998
[70] Jockel, pp. 54-55.

M109 self-propelled howitzer and Leopard tanks, both of which could be part of a Canadian contingency force.[71] Capable of carrying only about 17 tonnes at the relatively slow speed of 556 kilometres per hour,[72] the Hercules is considered more of a tactical than a strategic aircraft.[73] By comparison, the C-17 *Globemaster III*, America's latest strategic transport plane, has a payload capacity of over 77 tonnes and travels at 450 knots (about 850 kilometers per hour).[74] Whereas a fully equipped Hercules can only fly the equivalent of the distance between Trenton, Ontario and Gander, Newfoundland,[75] the C-17, with an unrefuelled range up to 4,350 nautical miles, can fly non-stop from North America to Kosovo.[76]

41. Canada is also limited in its sea lift capabilities. There are no dedicated naval transport ships for moving equipment overseas and DND must rent commercial vessels for this purpose or "hitch a ride" with its allies.[77] The CF's lack of military sea lift, combined with its need to find a replacement for the Navy's ageing AORs, has resulted in the Afloat Logistics and Sealift Capability (ALSC) project, which is designing a ship that would combine capabilities for fleet replenishment at sea, in-theatre support to joint forces ashore, and strategic lift for the Army.[78] Preliminary studies have already indicated that a Multi-Role Support Vessel, with its endurance and helicopter carrying capability, should be considered for this next generation of logistics support ships.[79] Such vessels would significantly improve the Canadian Forces' deployability and sustainability—although, considering time for refit and maintenance, there is some question as to whether the three ships planned would be sufficient in numbers to support both Army and Navy operations.[80]

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[71] Ibid., p. 62.

[72] "Air Force Facts & Stats," http://www.airforce.dnd.ca/eng/equip1k.htm

[73] John Ward, "Military to Shore Up Capital Spending," *Halifax Chronicle Herald*, 25 November 1999, p. D19.

[74] "C-17 Globemaster III," http://www.af.mil/news/factsheets/C_17_Globemaster_III. html

[75] Conversation with Major Mark MacDonald, Directorate of Defence Analysis, 28 March 2000.

[76] The C-17 has an unrefuelled range of 3,700 nautical miles. This increases by 15% to 4,350 nautical miles if the aircraft is equipped with an Extended Range Tank. See "C-17 Globemaster III," Technical Description and Planning Guidance, Boeing, August 1996.

[77] David Pugliese, "Canada's Aging Arsenal Not Fit to Fight a Real War," *Montreal Gazette*, 4 May 1999.

[78] Lieutenant-Commander Bruce Irvine, "Afloat Logistics Capability for the Canadian Navy," *Canadian Defence Quarterly* (Summer 1997), pp. 14-15.

[79] Navy Vision, http://www.dnd.ca/navy/marcom/part5vd.html

[80] Comments from Dr. Scot Robertson, Directorate of Defence Analysis, 28 March 2000.

42. Three concurrent initiatives are underway within DND to address Canada's strategic lift limitations. With respect to airlift, DPG 2000 directed the Air Force to determine "the capabilities and force structure required to provide strategic airlift for deployable forces and associated sustainment, with priority to Vanguard forces."[81] One such option may be to scale back the C-130 fleet and replace these aircraft with a fewer number of heavy transport planes, such as the C-17.[82] For sealift, DPG 2000 tasks the Navy to submit a preliminary ALSC project outline to senior management for approval by March 2001.[83] Looking at overall CF strategic lift capabilities is the Strategic Capabilities Planning document for the Canadian Forces.[84] The Plan recommends a three-tier blueprint for strategic lift: theatre opening assets to be deployed by air; vanguard forces to be deployed by CF-owned sealift assets; and main contingency forces to follow by commercial sea lift. The blueprint is premised on the view that "you can never effect strategic deployment entirely by air. Given the sheer weight of equipment, rations, spare parts, water, etc., it is unrealistic to impose a restriction on the army that it must be entirely air transportable. This is especially the case when you consider that many of the places we will be going to will have limited or non-existent airlift facilities."[85] In this context, it is clear that a *combination* of enhanced air and sea lift will be needed to ensure that the CF is more rapidly deployable.[86]

43. *Unmanned combat.* Canada has not made any concrete moves towards a third RMA doctrinal area, unmanned combat using unmanned combat aerial vehicles. This is not surprising, considering that the 1994 Defence White Paper explicitly stated that Canada would not seek a full range of capabilities. To date Canada's focus of attention has been on updating our manned fighters, the CF-18, and looking at future options for new manned fighters. The CF-18 is capable of both air-to-air combat and targeting troops and equipment on the ground. Measures to increase its air-to-ground precision strike capabilities were discussed earlier in this report. In addition, the

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[81] DPG 2000, p. 3-14.

[82] This was one option put forward by Chief of Defence Staff Maurice Baril in a November 1999 speech to the Canadian Club of Ottawa. See John Ward, "Military to Shore Up Capital Spending," *Halifax Chronicle Herald*, 25 November 1999, p. D19.

[83] DPG 2000, p. 3-5.

[84] Director General Strategic Planning, *Strategic Capabilities Planning for the Canadian Forces*, final draft dated 4 April 2000.

[85] Conversation with Cessford, 23 March 2000.

[86] Comments from Lieutenant-Colonel Paul Ward, Directorate Land Strategic Plans, 28 March 2000.

Air Force has begun the Fighter Aircraft Upgrade program which includes the installation of new radio and radar systems, friend or foe identification systems, electronic warfare jamming equipment and simulators. More recently, DND has spent US$10 million to sign on as an "informed partner" to America's Joint Strike Fighter project. This stealthy, multirole aircraft is being developed in three variants for the US Air Force, Navy and Marine Corps, as well as for Britain's Royal Navy, and is scheduled for service in 2008. As an "informed partner" Canada will be privy to information on the aircraft's initial development in the lead up to the choice of a contractor in 2001. Canada could eventually choose the Joint Strike Fighter to replace the CF-18.[87]

44. *Littoral warfare*. In the overall RMA context, a key change in naval doctrine is the move from open-ocean, "blue water" warfare between contending navies, and towards littoral warfare in support of joint forces ashore. Canada's navy has begun to change its focus from being an open ocean force, to one that can also conduct littoral operations in shallower, potentially more dangerous waters. An ALSC capability, in particular, will enable the Navy to support Canadian Forces ashore. Nonetheless, the Navy has none of the major tools for sea power projection onto land. For the US Navy, such capabilities include aircraft from carriers, ship-to-shore cruise missiles, and the amphibious landing capabilities of the Marines.[88] Canada's Frigates are already equipped with the *Harpoon* Surface-to-Surface Missile and the *Sea Sparrow* Surface-to-Air Missile. However, considering the utility of land attack cruise missiles in recent peace enforcement missions in Bosnia (1995) and Kosovo (1999), it may be useful for Canada to consider investing in these longer-range weapons. While America's *Tomahawk* cruise missile is considered out of the question due to cost, a feasible option may be the Stand-off Land Attack Missile.[89]

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[87] David Pugliese, "Air Power for the 21st Century," *Ottawa Citizen*, 25 November 1999, pp. A1 & A2.
[88] Jockel, p. 87.
[89] Conversation with Commander Kelly Williams, Directorate Maritime Strategy, 29 March 2000 and with Vice-Admiral James King, 29 March 2000.

CONCLUSION

45. It is clear from the foregoing that Canada is already undertaking a number of steps to respond to the opportunities presented by the Revolution in Military Affairs. With respect to RMA technology, the Canadian Forces is increasing its stocks of laser-guided precision munitions and enhancing its command and control capabilities. Doctrinally, it is striving to increase jointness among services, developing more rapidly mobile and flexible ground forces, and taking steps to acquire a strategic lift capability. Some of these doctrinal and organizational elements, however, are as yet an aspiration rather than a reality. Moreover, there are some notable gaps in RMA technology. They include GPS-guided precision systems, enhanced battlespace awareness capabilities such as operational and strategic unmanned aerial vehicles, and land attack missiles for sea power projection onto land.

46. As Canada continues to develop its approach to the RMA, it may want to bear in mind some important contextual factors. First, the 1994 White Paper argues for a multi-purpose, combat capable force that can respond to a range of operations, including not only peacekeeping and observer missions, but also enforcing the will of the international community and collective defence.[90] It follows, then, that Canada will want to identify and invest in those RMA technologies, doctrines and organizational concepts that are applicable to both low *and* high intensity operations. Advanced C4I and ISR systems, for example, are relevant to the efficient conduct of operations at all points along the spectrum of conflict. Unmanned aerial vehicles for reconnaissance have proved their worth in a range of conflict scenarios, from the high-intensity battlefield of the Gulf War, to the medium-intensity NATO operation in and around Kosovo, to the low-intensity task of monitoring the peace in Bosnia. Strategic lift is another good example of a capability that is suited to both high and low intensity tasks, while precision-guided munitions are clearly relevant both to warfighting scenarios and to the peace enforcement aspects of peace support operations.

46. More broadly speaking, if the Canadian Forces is to concretely support the achievement of Canada's future global security objectives it will need to be able to make a meaningful

contribution to coalition operations. In part this means maintaining and enhancing interoperability between the Canadian Forces and its most likely coalition partner, the United States Military. This will be no small undertaking as the United States continues to pursue an ambitious program of developing and integrating revolutionary technologies into its military forces. A plausible guiding framework may be to develop a force structure "that reflects suitable capability for the most likely forms of employment [i.e. peace support operations], while retaining the ability to integrate in a meaningful way with the RMA forces of the United States in confronting the most dangerous contingencies."[91] Beyond interoperability, making a meaningful contribution also involves maintaining a sufficient number of forces to form a combat relevant force, and ensuring that those forces are sustainable.

47. Finally, as Canada moves forward with its response to the RMA it may want to view the phenomenon as much as an *opportunity* as a *challenge*. The nature of the RMA is such that it has the potential to provide relatively greater benefits to small/medium powers, such as Canada, than to large powers like the United States. This is because the RMA is changing the fundamental components of power. Whereas the most important elements of a country's military potential used to be its population and the size of its economy, increasingly it is the quality of its standing forces, as opposed to the population as a whole, and of its high-tech sector, as opposed to the economy as a whole, that are the determining factors. Such a shift has important implications for Canada and the ability of the Canadian Forces to support Canadian foreign and security policy objectives. While the large, mass army of the Industrial era was not a feasible option for Canada, the smaller, more technologically capable force of the Information Age is well within its reach.

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[90] *1994 Defence White Paper*, pp. 31-32.
[91] Dewar.

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This paper discusses Canada and the Revolution in Military Affairs. It looks at the extent to which the concept is reflected in current Canadian defence policy, examines measures Canada is taking in the key technological and doctrinal/organisational areas of the RMA, and outlines some important contextual factors Canada may want to bear in mind as it continues to develop its approach to the RMA. The paper concludes that while the large, mass army of the Industrial era was not a feasible option for Canada, the smaller, more technologically capable force of the Information Age is well within its reach

Ce document porte sur le Canada et la Révolution dans les affaires militaires (RAM) Il examine dans quelle mesure ce concept se reflète dans la politique de défense du Canada, il se penche sur les mesures adoptées par le Canada dans les principaux secteurs technologiques et doctrinaux/organisationnels de la RAM, et il décrit quelques facteurs contextuels importants dont le Canada devrait peut-être tenir compte dans son approche à l'égard de la RAM. La conclusion du document est la suivante : le Canada n'aurait pas pu se doter d'une armée gigantesque du type de celles qui ont dominé l'ère industrielle, mais il est très capable de se doter d'une armée digne de l'ère de l'information, c'est-à-dire plus petite et davantage axée sur la technologie.

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